



Case Report

Total maxillary arch distalization using clear aligners facilitated with a modified C-palatal plate in a bimaxillary protrusion patient: A case report

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Abstract

This case report demonstrates that using Clear Aligners (CA) in conjunction with a modified C-palatal plate (MCP) for distalizing the maxillary arch can be an efficient approach for treating malocclusions. This method compared to CA therapy, would possibly decrease the number of aligners, eliminate unnecessary interproximal enamel reduction (IPER) and reduce treatment time for the same amount of movement. A female patient with skeletal and dental Class I relationships and bimaxillary protrusion was treated. Orthodontic records were taken, and a palatal retraction arch (PRA) was bonded to the upper first molars. After activating the MCP, the aligners were used. The treatment period was 15 months. The patient's soft tissue profile improved after distalizing the maxillary arch using CA with MCP and the mandibular arch using mini-implants. This case report suggests that using CA with MCP may be advantageous in severe malocclusion cases requiring significant tooth movement.

Keywords: Orthodontic appliances; Distalization; MCP, Clear aligner therapy

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1. Introduction

Patients with bimaxillary protrusion often face facial and esthetic issues due to the unattractive appearance of the protruded upper and lower lips. Extraction of the first premolars in the upper and lower arch and closing the space by retracting the anterior teeth was the traditional method for correcting bimaxillary protrusion.¹ Although this method could improve the facial profile, many patients find the extraction of four permanent teeth undesirable.

Recently, adult orthodontic patients have shown a desire for more aesthetic and simple orthodontic appliances compared to fixed braces.^{2,3} Clear Aligners (CA) are invisible, aesthetic, removable, and comfortable.^{4,5} Researchers have focused on the effectiveness of CA by measuring individual tooth movements and using this information to improve aligner materials and 3D software development.^{6,7}

Several studies have reported sequential maxillary molar distalization using CA and the potential for dental Class II correction.⁸⁻¹⁰ Simon et al. concluded that tooth movements can be achieved with aligners such as molar distalization, premolar derotation, and incisor torque.⁸ Ravera et al. stated that aligners with attachments can distalize maxillary first molars along with using Class II elastics. The result showed without drawbacks such as distal tipping and extrusion, 2.25 mm distalization of molar was achieved in an average of 24.3 $\pm$ 4.2 months.⁹

However, Zhang et al. found that clear aligners primarily move crowns, not roots, due to their tilting motion.¹¹ Additionally, Patterson et al. reported that the Invisalign® system cannot achieve all tooth movements successfully with some errors in tooth movement predictions. Besides, orthodontic elastics did not improve significantly for

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correcting Class II malocclusion in an average of over 7 months.¹²

With temporary anchorage devices (TADs), the retraction of anterior teeth after molar distalization has become a preferred non-extraction treatment method for protrusive anterior teeth.¹³⁻¹⁵ The modified C-palatal plate (MCP) is a simple and effective appliance for total maxillary arch distalization.¹⁶ Several articles have reported the treatment and post-treatment effects of MCP for correcting maxillary protrusion in adults and adolescents.¹⁶⁻¹⁸ MCP can avoid root perforations and overcome the limited range of action due to restricted interradicular space.¹⁹

In this case report, we introduce a new method for total maxillary arch distalization using CA facilitated with MCP and mini-implants for mandibular arch distalization to achieve camouflage orthodontic treatment in bimaxillary protrusion patient.

2. Diagnosis

A 20-year-old female patient presented with a chief complaint of upper and lower protrusive lips. The patient had no known medical history and dysfunction of the temporomandibular joint. The orthodontic diagnosis was skeletal and dental Class I bimaxillary protrusion. Clinical examination revealed moderate spacing in the upper anterior teeth and mild crowding in the lower arch, with a full metal crown on the lower right first molar. The upper midline was shifted 1 mm to the right, while the lower and the facial midline were coincident (Figure 1).

A lateral cephalometric analysis before treatment (T1) showed skeletal Class I (ANB, 2.6°) bimaxillary protrusion (Upper lip – TVL, 9.0 mm, and lower lip – TVL, 7.2 mm) with a long face pattern (FMA, 31.7°). The upper incisors were proclined (U1–SN, 112.5°) (Figure 2A and Table 1). All permanent teeth were observed except for the upper third molars, and the lower third molars were present in the initial panoramic radiograph (Figure 2 B).

3. Treatment Objectives

The treatment objectives were to (1) reduce lips protrusion, (2) obtain normal overjet and overbite (3), close upper anterior spacing with correcting midline, (4) maintain Class I canine and molar relationships, (5) and improve the facial profile and esthetics.

4. Treatment Alternatives

After the orthodontic diagnosis, the first option of treatment was the extraction of four first premolars to correct the upper and lower protrusion. However, the patient declined this option. Another option of treatment involved distalizing the maxillary molars using a modified C-palatal plate (MCP) and using upper Clear Aligners (CA) for the sequential distalization of individual maxillary teeth.

For the mandibular arch, distalization was achieved using transitional anchorage devices (TADs) combined with fixed metal braces to maximize retraction, as the patient rejected the use of lower CA with interproximal enamel reduction. This treatment approach aimed to achieve the maximum retraction of the maxillary and mandibular arches, similar to the results of extracting four premolars.

5. Treatment Progress

The patient was bonded with fixed metal brackets (0.022-in MBT prescription brackets, Clippy-C, Tomy, Tokyo, Japan) on the lower arch, and TADs with mini-implants (1.6 mm in width and 8 mm in height, Ortho Anchor TM, Osstem Implant TM, South Korea) were inserted between the mandibular first and second molars on both the right and left sides. An MCP was placed in the palate with three mini-screws (2 x 8 mm; Jeil Medical, Seoul, Korea). Approximately 250 g of force was applied to the hooks of the palatal retraction arch (PRA) and the hooks of the palatal plate on the MCP using elastomeric chains (Figure 3).

Table 1: Cephalometric measurements at different stages of the treatment.

Measurements	Mean	T1	T2
Skeletal			
SNA (°)	82.0	78.7	77.9
SNB (°)	80.0	76.1	76.3
ANB (°)	2.0	2.6	1.6
FMA (MP-FH) (°)	24.0	31.7	29.3
Total Face Height (N-Me) (mm)	115.0	123.0	123.4
Dental			
Overjet (mm)	3.2	4.7	3.6
Overbite (mm)	3.2	4.0	3.7
Max 1 – SN (°)	102.8	112.5	103.8
Max 1 – Palatal plane (mm)	28.0	32.5	32.6
Max 6 crown to PTV (mm)	18.0	14.6	11.0
Max 6 crown – Palatal plane (mm)	23.0	22.7	22.8
Mand 6 crown to Mn Plane (mm)	32.1	28.9	28.8
Molar relation (mm)	-3.0	-3.7	-3.5
Interincisal Angle (U1-L1) (°)	130.0	114.7	127.7
FMIA (L1-FH) (°)	64.0	59.6	62.6
Soft tissue			
Upper Lip - TVL (mm)	5.0	9.0	5.9
Lower Lip -TVL (mm)	2.5	7.2	4.2
Nasolabial angle	104	82.1	95.0

TVL; True Vertical Line. T1; measurements before treatment. T2; posttreatment measurements.

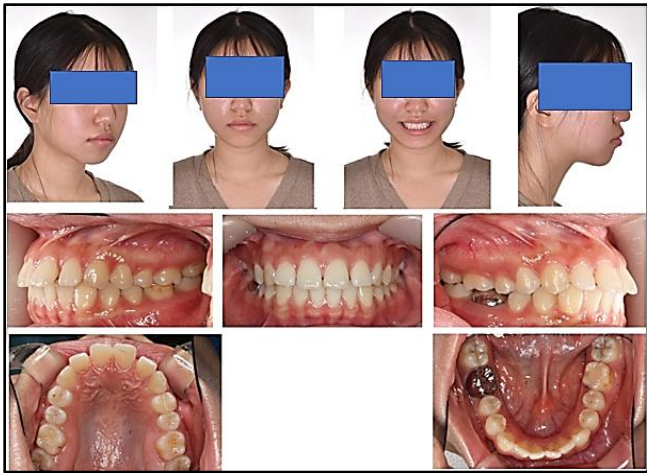


Figure 1: Pre-treatment intraoral and facial photographs

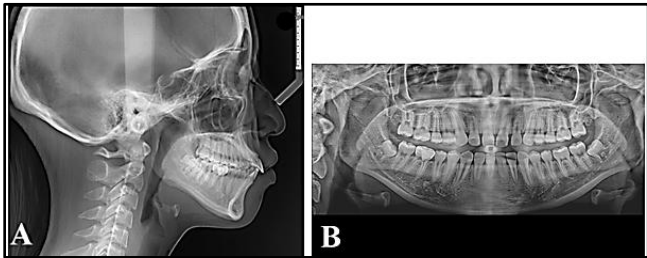


Figure 2: (A), Pre-treatment lateral cephalogram; (B) Pre-treatment panoramic X ray



Figure 3: Intraoral photographs after bonding lower arch and placement of MCPP

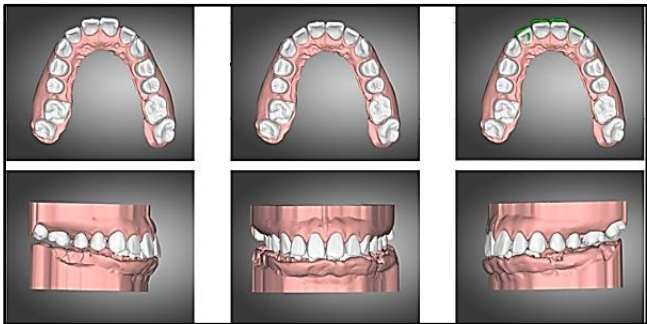


Figure 4: Dental casts at treatment progress with CA facilitated with MCPP for maxillary molar distalization

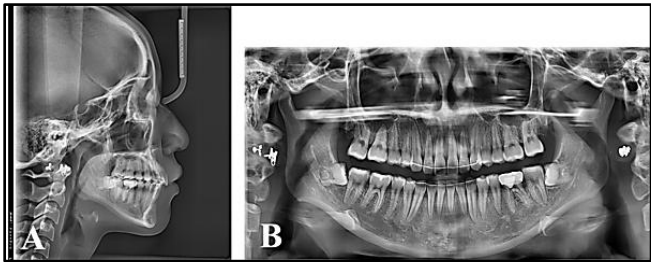


Figure 5: (A), Posttreatment lateral cephalogram; (B) Posttreatment panoramic X ray

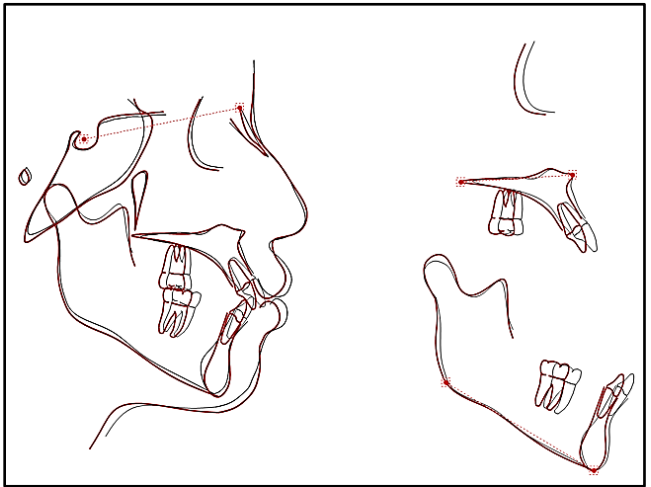


Figure 6: Superimposition initial (T1) with final (T2)

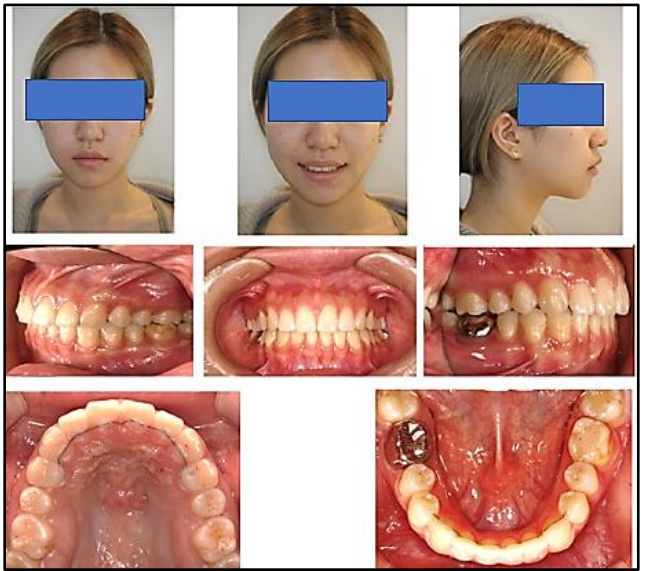


Figure 7: Posttreatment intraoral and facial photographs

The CA with an individual tooth movement prescription was delivered simultaneously after the MCPP placement to ensure bodily distal movements of the upper molars. Sequential movements of the premolars, canines, and incisors were prescribed with each CA to follow along with the MCPP-facilitated molar distalization. The distalization of the maxillary molars continued for 9 months from the initial installment, with elastics being changed monthly. The

sequential retraction of premolars, canines, and anterior teeth with CA continued along with molar distalization by MCP (Figure 4).

Corresponding to the upper retraction, lower arch distalization and retraction were facilitated with mini-implants to establish an optimal overjet and overbite. Orthodontic records were collected after completing the upper CA treatment with MCP and lower fixed braces treatment combined with mini-implants. The cephalometric analysis of the post-treatment lateral cephalogram, panoramic radiograph and clinical evaluation were analyzed (Figure 5 and Table 1). Enhancement of the dental and soft tissue relationships was demonstrated in the superimposition of initial and final lateral cephalometric radiographs (Figure 6). The total treatment period was 15 months and the patient was very happy with the treatment outcome. (Figure 7).

6. Treatment Results

The orthodontic treatment with CA-facilitated maxillary molar distalization with MCP for sequential retraction of maxillary teeth, and lower mini-implants facilitated mandibular arch distalization, was successful in establishing a normal range of overbite and overjet with an improved facial profile. Post-treatment (T2), the maxillary first molar was distalized by 3.6 mm. The inclination of the maxillary incisor (Max1 – SN) changed from 112.5° to 103.8°. The mandibular first molar had 3.8 mm of distalization with mini-implants at T2. The upper and lower lips retracted by 3.1 mm and 3.0 mm, respectively, and the nasolabial angle increased by 12.9° at T2 (Table 1 and Figure 7).

7. Discussion

The treatment of various malocclusion types in adults and adolescents with Clear Aligners (CA) has increased over the last decade.²⁰ CA orthodontic treatment provides an aesthetic option that allows for good oral hygiene, healthy periodontium, and root safety compared with outcomes reported by treatment with conventional fixed braces.^{21,22} However, the ability of aligners to distalize molars and address major orthodontic issues remains controversial.^{11,12}

Simon et al. demonstrated a mean of 2.6 mm distal movement of the first molar in a sample of ten patients treated with clear aligners.⁸ In adult patients, Ravera et al. reported distal movements of 2.25 mm for the upper first molars and 2.52 mm for the upper second molars using CA with composite resin attachments and intermaxillary elastics.⁹ However, this method is unsuitable for bimaxillary protrusion due to the mesialization of mandibular molars.

Patterson et al. found that the ability of clear aligners to correct Class II malocclusion patients was only 6.8% of the predicted amount, with no significant improvements observed when using Class II elastics after a mean treatment duration of 7 months since starting of aligners treatment.¹²

This case report aimed to show a new approach for treating severe malocclusion cases requiring significant tooth movement using CA and a modified C-palatal plate (MCP). The patient declined to use fixed braces on the maxillary teeth and accepted CA without attachments. Post-treatment (T2), the upper first molar with MCP was distalized by 3.6 mm. In agreement with our results, Kook et al. reported 3.3 mm distal movement of the maxillary first molar with MCP, along with 3.4° of distal tipping and 1.8 mm of intrusion.¹⁶ Additionally, a retrospective study comparing extraction and non-extraction patients with severe overjet reported 5.4 mm distalization of the first molar using MCP.²³

During molar distalization with MCP, CA was used to sequentially retract the premolars and anterior teeth. The upper anterior teeth retracted, and the inclination of the upper incisor (Max1 – SN) changed from 112.5° to 103.8° post-treatment (T2). Retraction of the anterior teeth with CA was achieved without anterior intrusion or extrusion (Max 1 – palatal plane at T1: 32.5 mm and at T2: 32.6 mm), indicating the possibility of translation movement of maxillary premolars and anterior teeth using CA after molar distalization with MCP.

Park et al. compared treatment outcomes between MCP and cervical pull headgear after distalization of maxillary dentation in adults and reported anterior extrusion with both methods.^{24,25} The serial method of distalization with CA reduces space opening between the distalizing teeth, providing a more aesthetic result and maintaining maximum contact between aligner and the teeth. This decreases the flexibility of the aligner material, minimizing uncontrolled incisor tipping, which clinically manifests as increased overbite with loss of palatal root torque.²⁵

Djeu et al. concluded that Invisalign® did not treat occlusal contacts and severe anteroposterior malocclusions as effectively as braces. However, Invisalign® was effective at closing spaces and correcting rotated anterior teeth and leveling the marginal ridge heights.²⁶

For the patient in this study with bimaxillary protrusion, the initial decision was total mandibular arch distalization using aligners with interproximal enamel reduction. However, mini-implants were used instead of CA because the patient rejected enamel stripping. Mini-implants were inserted between the roots of the mandibular first and second molars to retract the mandibular dentation without touching the roots, given the thicker cortical bone in posterior mandible.²⁷ The average space between the roots of the lower first and second molars is 4.57 mm.²⁷

The mandibular molars were distalized by 3.8 mm using mini-implants inserted between the lower molars. Previous researches on TADs in Class III malocclusion patients reported distalization of mandibular molar ranging from 1.8 mm to 4.9 mm, including distal tipping.²⁸⁻³⁰ Yeon et al.

reported an average distalization of 1.8 mm for mandibular first molars with mini-implants.³⁰

The patient had a hyperdivergent facial pattern pre-treatment (FMA 31.7° and total face height 123 mm). Distalization of both upper and lower molars was achieved without molar extrusion, preventing an increase in facial height. Previous studies reported maxillary first molar intrusion ranging from 1.4 mm to 1.8 mm after distalization with MCP. Following distalization of both arches, the soft tissue profile improved significantly. The upper and lower lips retracted by 3.1 mm and 3 mm, respectively, and the patient was satisfied with the final treatment results.

8. Conclusion

The utilization of Clear Aligners (CA) augmented by a modified C-palatal plate (MCP) proved effective in achieving total maxillary arch distalization, thereby correcting maxillary anterior protrusion in a patient with bimaxillary protrusion. This was accomplished without resorting to extractions or interproximal enamel reductions (IPER). Given the outcomes observed in this case, clinicians are encouraged to consider the CA-MCP combination as a viable alternative for patients who are averse to conventional fixed braces, tooth extractions, and IPER when managing severe dental protrusions. This approach may offer a less invasive and patient-preferred option in orthodontic treatment strategies.

9. Source of Funding

None.

10. Conflict of Interest

None.

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